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(21)Application number : 2001-120690 (71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
CANON INC

(22)Date of filing : 19.04.2001 (72)Inventor : MIYATAKE NORIO
NISHIKAWA KOICHIRO
ANDO HIROTAKE

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(54) THERMAL TREATMENT EQUIPMENT FOR OPTICAL DISK

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an optical disk thermal treatment equipment, in which tracking of a heat treatment beam can be performed along virtual lines on a 1st wobble pit 16 and a 2nd wobble pit 17 which can smoothly carry out magnetic domain wall displacement detection operation in a high-density disk of a magnetic domain wall displacement detection system(DWDD).
SOLUTION: A laser beam is split into a plurality of optical paths 32, 33, and 34, heat-treatment is carried out by the split beam 33 being one of the split beams to the optical disk 1, and tracking is carried out with other split beams 32 and 34. As a result, areas between recording and reproducing tracks can be heat-treated with sufficiently narrow heat treatment width compared with a track pitch while keeping stable tracking

characteristics.

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CLAIMS

[Claim(s)]
[Claim 1] The optical disk thermal treatment equipment characterized by dividing laser light into two or more optical paths, heat-treating by one of said the division light to an optical disk, and performing tracking with other division light.
[Claim 2] The optical disk thermal treatment equipment characterized by having the recording layer arranged above a substrate and said substrate, dividing into two or more optical paths the laser light by which is the thermal treatment equipment of the optical disk which reproduces an information signal using the light by which incidence

is carried out from said substrate side, and incidence is carried out from a recording layer side, heat-treating said recording layer by one of said the division light, and performing tracking with other division light.

[Claim 3] The optical disk thermal treatment equipment according to claim 1 or 2 whose tracking method of record playback of an optical disk is a sample servo system.

[Claim 4] An optical disk thermal treatment equipment according to claim 1 to 3 with a spot size of the division light used for heat treatment smaller than the spot size of the division light used for tracking.

[Claim 5] The optical disk thermal treatment equipment of the publication from any of claims 1-4 whose wavelength of laser light is 500nm or less.

[Claim 6] The optical disk thermal treatment equipment according to claim 1 to 5 whose optical disk is a magneto-optic disk of a domain-wall-displacement detection method (DWDD).

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacturing installation of the optical disk used for informational record or playback.

[0002]

[Description of the Prior Art] In the field of the optical disk, recording information on high density more is called for. As an approach of realizing such high density record, the optical disk of a DWDD (Domain Wall Displacement Detection) method (domain-wall-displacement detection method) is proposed.

[0003] In the optical disk of a DWDD method, it is the method which can reproduce an information signal to a high resolution using the migration phenomenon of a magnetic domain wall. By irradiating a playback light beam and heating a recording track to the magneto-optic-recording medium by which record was performed as a set of the minute mark section formed with the magnetic domain wall along the recording track,

a magnetic domain wall is made to generate the migration force, a magnetic domain wall is moved at high speed, and an information signal is reproduced by detecting the migration.

[0004] A playback light beam is irradiated as mentioned above, and in order to make the magnetic domain wall of the record mark section recorded along the truck generate the migration force, it is necessary to weaken magnetic association between adjoining recording tracks. For this reason, in manufacturing the optical disk of a DWDD method, before recording an information signal, it performs heat treatment (it is also called initialization or annealing treatment) which weakens magnetic association between adjoining recording tracks. It is attained by weakening magnetic association by this heat treatment approach's irradiating the light beam converged on 1 micrometer or less between recording tracks, heating between recording tracks, and reducing the magnetic anisotropy of the heated part. About such a heat treatment approach, it is proposed from the former (refer to JP,6-290496,A and JP,10-340493,A).

[0005] About the structure of the conventional optical disk, and the approach of heat treatment, an example is shown in drawing 9 . As shown in drawing 9 , the conventional optical disk 1 is equipped with a substrate 2, and the 1st dielectric layer 3 and recording layer 4 by which the laminating was carried out one by one on the substrate 2, the 2nd dielectric layer 5 and the protection coat layer 6. The groove section 7 is formed in the front face by the side of the recording layer 4 of a substrate 2. Between the two groove sections 7 which adjoin in the direction of a path, it is the part called a land 8. By such disk with a slot, there are two kinds in the case (land record is called) of recording data on the case (groove record being called) where data are recorded on the groove section 7, and a land 8. In the case of groove record, although the DWDD disk using a substrate with a slot also has groove record and land record, here explains.

[0006] By the conventional DWDD disk, the width of face of the groove section 7 is 0.8 micrometers, and the width of face of a land 8 is 0.4 micrometers. A recording layer 4 is equipped with the magnetic layer of three or more layers in order to reproduce by the DWDD method.

[0007] Next, the heat treatment approach of an optical disk 1 is explained. In heat treatment of an optical disk 1, it becomes possible by irradiating the laser light 9 (for example, laser power:mW [10], wavelength =680nm, NA=0.55 of an objective lens 10) for heat treatment along with a land 8 to vanish magnetic association of the recording layer 4 on a land 8. In this heat treatment process, the passing speed of the optical spot of the laser light 9 is 3m/second.

[0008]

[Problem(s) to be Solved by the Invention] In order to enforce the above heat treatment approaches, it needed to be made the disk which formed the groove section

7 generally called disk with a slot, and a land 8. In performing record playback in the groove section 7, it is made to run the laser light 9 which converged with the objective lens 10 of a thermal treatment equipment along with a land 8, and heat-treats a land 8. It is common to take the tracking technique, such as a push pull method, as a means to make it run the laser light 9 along with a land 8 here.

[0009] However, if a land 8 tends to be heat-treated and it is going to perform record playback in the groove section 7 when using a disk with a slot, the land 8 with a good tracking property must be formed. As shown in drawing 10 for that purpose, the level difference 11 between a land 8 and the groove section 7 needed to be made about [of the wavelength of the light beam for heat treatment] into lambda/8, and this had the technical problem were not suitable, in order to perform DWDD playback. However, 2 is a substrate here and 3, 4, or 5 is the 1st dielectric layer, recording layer, and 2nd dielectric respectively. The protection coat 6 is not illustrated.

[0010] That is, when about lambda/8 level difference was prepared, it was difficult, and as shown in an enlarged drawing, the fluctuation 12 of a minute groove section side face arose, and it became clear [that this bars DWDD actuation] to form a smooth groove. It is necessary for it to be necessary to make smooth DWDD actuation perform also at the time of record of the short marks following 0.3 micrometers, in order to make high density attain, and to lose fluctuation of this groove section side face for that purpose, or to lessen.

[0011] The sample servo system without adoption of lambda/10 or less very shallow sample servo system with a groove (slot) of the wavelength of the above-mentioned light beam for heat treatment or a groove was thought as an approach of losing fluctuation of the above-mentioned groove section side face, or lessening. Drawing 11 is the example of the sample servo system disk at the time of forming the very shallow groove section 7, and is drawing seen from the pit forming face. In drawing 11 , 13 is a servo field, 14 is a data area, and the segment field 15 is formed in the servo field and the data area.

[0012] The 1st wobble pit 16 and the 2nd wobble pit 17 are established in the servo field. The data area 14 along the record regenerative track 19 is used for record playback. The land to which heat treatment met the heat treatment truck 20 is performed.

[0013] The reason for having prepared the very shallow groove has little fluctuation of the above-mentioned minute groove section side face, and is because it has some effectiveness which prevents diffusion of the heat of a heat treatment beam. however, a heat treatment beam -- the above-mentioned pole -- irradiating the land of the disk which prepared the shallow groove had the unstable tracking of a heat treatment beam, and the tracking control characteristic of a heat treatment beam was a technical problem.

[0014] On the other hand, drawing 12 is the top view which looked at the usual sample

servo system disk without a slot from the side by which a record playback beam is irradiated like the above. In drawing 12 , 13 is a servo field, 14 is a data area, the segment field 15 is formed in a servo field and a data area, and the 1st wobble pit 16 and the 2nd wobble pit 17 are established in the servo field. There is no truck of 21 record regenerative track used for record playback where a data area is physical at plate-like voice, and the imaginary line top passing through between the 1st wobble pit 16 and the 2nd wobble pits 17 serves as this record regenerative track 21. And the heat treatment truck which must heat-treat is 22. The heat treatment truck 22 is on the imaginary line which passes along right above [of the 1st wobble pit 16 or the 2nd wobble pit 17].

[0015] In the imaginary line top passing through between such a 1st wobble pit 16 and the 2nd wobble pits 17, carrying out the tracking of the record playback beam is performed by the usual sample servo technique. However, the light beam for heat treatment passed the heat treatment truck 22 on the 1st wobble pit 16 and the 2nd wobble pit 17, and if it was ****, it had the technical problem that there was nothing.

[0016] This invention aims at offering the optical disk thermal treatment equipment to which the tracking of the heat treatment beam can be carried out along the imaginary line top on the 1st wobble pit 16 and the 2nd wobble pit 17 in order to solve said conventional problem.

[0017]

[Means for Solving the Problem] In order to attain said purpose, the 1st optical disk thermal treatment equipment of this invention is characterized by dividing laser light into two or more optical paths, heat-treating by one of said the division light to an optical disk, and performing tracking with other division light.

[0018] The 2nd optical disk thermal treatment equipment of this invention is characterized by having the recording layer arranged above a substrate and said substrate, dividing into two or more optical paths the laser light by which is the thermal treatment equipment of the optical disk which reproduces an information signal using the light by which incidence is carried out from said substrate side, and incidence is carried out from a recording layer side, heat-treating said recording layer by one of said the division light, and performing tracking with other division light.

[0019] In said 1-2nd optical disk thermal treatment equipments, it is desirable that the tracking method of record playback of an optical disk is a sample servo system.

[0020] Moreover, it is desirable that the spot size of the division light used for heat treatment is smaller than the spot size of the division light used for tracking.

[0021] Moreover, it is desirable that the wavelength of laser light is 500nm or less.

[0022] Moreover, it is desirable that an optical disk is a magneto-optic disk of a domain-wall-displacement detection method (DWDD).

[0023] To the optical disk of the sample servo system which arranges two or more wobble pits of A and B pair, and performs tracking, this invention divides laser light

into two or more optical paths, heat-treats by one of the division light, and performs tracking with other division light as explained above. Moreover, it is the optical disk of the sample servo system which arranges two or more wobble pits of A and B pair, and performs tracking, and it has the recording layer arranged above a substrate and said substrate, the laser light by which incidence is carried out from a recording layer side is divided into two or more optical paths in the optical disk which reproduces an information signal using the light by which incidence is carried out from said substrate side, it heat-treats by one of the above-mentioned division light, and tracking is performed with other division light. Thereby, since the spot size of the division light used for heat treatment is smaller than the spot size of the division light used for tracking, heat treatment is possible by narrow width of face.

[0024]

[Embodiment of the Invention] The gestalt of operation of this invention is explained using drawing 8 from drawing 1 below.

[0025] (Gestalt 1 of operation) Drawing 1 is the principle Fig. having shown the configuration of the thermal treatment equipment of this invention. A disk rotates in the direction of an arrow head 31 by the disk rolling mechanism which a disk 1 and the optical head 30 are arranged and is not illustrated. Moreover, although not illustrated, an optical head can move to radial [of a disk] according to an optical head transport station. The light which came out of the optical head is divided into three beams, 32, 33, and 34. 33 is a beam for heat treatment and 32 and 34 are the beams for tracking. The physical relationship of a disk and each beam is explained using drawing 2 which is the top view seen from the record film forming face.

[0026] In drawing 2 , 16 and 17 are the 1st wobble pit and the 2nd wobble pit respectively, and the imaginary line 21 between the 1st wobble pit 16 and the 2nd wobble pit 17 is a record regenerative track. The line passing through each pit top of the 1st wobble pit 16 and the 2nd wobble pit 17 is the heat treatment truck 22.

[0027] 15 is a segment and each segment consists of a servo field 13 and a data area 14. The beam 33 for heat treatment and the beams 32 and 34 for tracking are irradiated on a disk 1, and the optical spot 35 for heat treatment and the optical spots 36 and 37 for tracking are formed.

[0028] The optical spot 35 for heat treatment is controlled to pass along the heat treatment truck 22 on the 1st wobble pit 16 or the 2nd wobble pit 17. Therefore, the optical spot 36 for tracking and the optical spot 37 for tracking are controlled to pass through between [21] the 1st wobble pit 16 and the 2nd wobble pits 17 (i.e., a record regenerative track) respectively by the sample servo system.

[0029] Since the distance of the distance of the optical spot 35 for heat treatment and the optical spot 36 for tracking, the optical spot 35 for heat treatment, and the optical spot 37 for tracking is designed so that equally, if the optical spot 36 for tracking and the optical spot 37 for tracking pass through the record regenerative

track 21, the optical spot 35 for heat treatment will pass the meantime exactly, will meet the line passing through the 1st wobble pit 16 or 2nd wobble pit 17 top, and heat treatment will be performed.

[0030] Rotation of a disk 1 round locates each optical spot in the location shown in the right-hand side of drawing 2 . That is, it moves to an adjoining truck. The amount of migration is a part for one track pitch of record playback. Therefore, if it heat-treats by rotating a disk, the disk is heat-treated along with the line on the 1st wobble pit 16 and the 2nd wobble pit 17.

[0031] How to make the three above-mentioned light beams is returned and explained to drawing 1 . The optical head 30 consists of laser 40, a collimate lens 41, a diffraction grating 42, the deviation beam splitter 43, the quadrant wavelength plate 44, the mirror prism 45, a concave lens 46, an objective lens 10, and a photo detector 47. However, the actuator for driving an objective lens in the direction of a focus or the direction of tracking (radial [of a disk]) is omitted.

[0032] The light beam of the linearly polarized light (in the case of drawing P polarization) which came out of laser 40 serves as parallel light with a collimate lens 41, and is divided into three beams by the diffraction grating 42. A polarization beam splitter 43 passes P polarization, and serves as a design reflected to S polarization. Therefore, the light divided into three passes a polarization beam splitter, and goes into the quadrant wavelength plate 44.

[0033] Each light beam serves as the circular polarization of light with the quadrant wavelength plate 44, and an include angle can be bent 90 degrees by the mirror prism 45. Next, it is condensed on the 1st page of a disk with an objective lens 10, and three spots 35, 36, and 37 are formed. It is condensed with an objective lens 1, and is reflected by the mirror prism 45, and the light reflected from the disk 1 goes into the quadrant wavelength plate 44. Since the circular polarization of light component is main, most reflected light returns to the linearly polarized light again with the quadrant wavelength plate 44. Since it is S polarization to the polarization beam splitter 43 at this time, light does not return but is reflected in the direction of laser above the drawing.

[0034] The reflected light is expanded with a concave lens 46, and three beams go into a photo detector 47, respectively. The photo detector 47 is divided into three fields 47a, 47b, and 47c. The light included in field 47b corresponds to the light which returned from the optical spot 35 for heat treatment on a disk side. The light included in field 47a and field 47c corresponds to light respectively from the optical spots 36 and 37 for tracking on the 1st page of a disk.

[0035] Field 47b of a photo detector 47 is divided into four more fields, and focal detection is made by the operation of the light of these four fields. Focal detection can be carried out by the ASUTIGUMA method, using the reverse boiled-fish-paste-like concave lens 46 as the one approach of focal detection.

[0036] In the case of the gestalt of this operation, the fields 47a and 47c of a photo detector 47 consist of one field respectively. If the optical spots 36 and 37 for tracking run a disk 1 top in the direction of the right from the left of drawing relatively as shown in drawing 3 , the quantity of light included in the fields 47a and 47c of a photo detector 47 will become like the quantity of light 50 and the quantity of light 51 respectively. 52 is the level of the quantity of light 0 here.

[0037] If the optical spot 36 for tracking of drawing 3 is seen, since only deltas will shift and it will run only s to the direction under drawing for a while rather than the record regenerative track 21, When it passes through the location where the 1st wobble pit 16 and the 2nd wobble pit 17 exist, a modulation factor serves as the modulation amplitude A1 small in the place of the 1st wobble pit 16, and when it passes through the location where the 2nd wobble pit 17 exists, it becomes the big modulation amplitude B1 of a modulation factor. The time difference tw in which the modulation amplitude A1 and the modulation amplitude B1 appear is time amount to which the optical spot 36 for tracking passes through the 1st wobble pit 16 and 2nd wobble pit 17 top.

[0038] On the other hand, if the optical spot 37 for tracking is seen, since only deltas will shift and it will similarly run only s to the direction under drawing for a while rather than the record regenerative track 21, when a modulation factor passes through the location where it becomes big amplitude B-2 in the place of the 1st wobble pit 16, and the 2nd wobble pit 17 exists, it becomes the amplitude A2 with a small modulation factor. The time difference in which amplitude B-2 and the amplitude A2 appear also serves as above tw. In addition, as for the time relation which the optical spot 36 for tracking and the modulation of 37 receive by the 1st wobble pit 16 and the 2nd wobble pit 17, only t shifts. This is because the optical spot 37 for tracking precedes to the optical spot 36 for tracking only for t hours. Each optical spot assumes the case where it moves rightward from the left of space here.

[0039] In order for there to be along the middle location of the record regenerative track 21 and to run it the optical spot 35 for heat treatment, it controls by 1, 2, or following 3. 1) Make it equal [the modulation amplitude A1 and B-2 in case the optical spots 36 and 37 for tracking pass through the 1st wobble pit 16 top respectively]. 2) Make it equal [the modulation amplitude B1 and A2 in case the optical spots 36 and 37 for tracking pass through the 2nd wobble pit 17 top]. 3) Make the relation of each amplitude when passing through the 1st wobble pit 16 and 2nd wobble pit 17 top the optical spots 36 and 37 for tracking set to B-2-A2=A1-B1.

[0040] However, when distance of the radial direction (the transit direction and direction which intersects perpendicularly) of the optical spots 36 and 37 for tracking is set to L1 and the pit pitch of the radial direction of the 1st wobble pit 16 or the 2nd wobble pit 17 is respectively set to LW1 and LW2, it must design so that L1 !=nxLW1 and L1 !=nxLW2 (n is the positive integer of arbitration) may be realized. When the

above is equal, even if the optical spots 36 and 37 for tracking shift towards up-and-down with a drawing, the modulation amplitude A1 and B-2 are always equal, and are fluctuating both of the values to coincidence. It is because the relation of the modulation amplitude B1 and A2 cannot become the same, either and cannot be controlled by this, of course.

[0041] Next, how to realize control of the above 3 is explained using drawing 4 . In drawing 4 , 47a and 47c are the photo detectors in the optical head 30 respectively shown in drawing 1 . The reflected light from the optical spots 36 and 37 for tracking respectively shown in drawing 1 goes into photo detectors 47a and 47c. The signal which the signal detected by the photo detector was amplified with amplifier 60 and 61, and was amplified with amplifier 60 and 61 is inputted into four sample hold circuits 62, 63, 64, and 65. The output of sample hold circuits 62 and 63 is inputted into the differential amplifier 66, and the difference calculates it.

[0042] On the other hand, the output of sample hold circuits 64 and 65 is inputted into the differential amplifier 67, and the difference calculates it. The output of differential amplifier 66 and 67 is further inputted into the differential amplifier 68, and the difference calculates it. The output of the differential amplifier 68 is inputted into the drive amplifier 69, and the actuator 70 for carrying out the tracking of the optical head with the output is controlled. 71 supplies the timing signals p1, p2, p3, and p4 of sample hold to sample hold circuits 62, 63, 64, and 65 by the timing signal generator. A timing signal p1 is supplied to a sample hold circuit 64 to the timing of t1+nT (n is a positive integer), and timing signals p2, p3, and p4 are respectively supplied to sample hold circuits 62, 65, and 63 to the timing of t1+t+nT, t1+tw+nT, and t1+t+tw+nT (n is a positive integer).

[0043] About the generation means of each of these timing signals, although it is omitting since it is easy here, it is generable based on change of the signal quantity of lights 50 and 51 when passing through the timing signal generated based on the clock pit (it is omitting from the pit plot plan of a disk) arranged at a sample servo system disk, the 1st wobble pit 16, and the 2nd wobble pit 17.

[0044] Therefore, with a timing signal p1 (=t1+nT), modulation amplitude B-2 shown by drawing 3 is outputted from the sample hold circuit 64 which carries out sample hold. From the sample hold circuits 62, 65, and 63 which carry out sample hold with timing signals p2, p3, and p4 similarly, the modulation amplitude A1, A2, and B1 is outputted respectively.

[0045] The differential amplifier 67 outputs the difference of modulation amplitude B-2 and A2, and the differential amplifier 66 outputs the difference of the modulation amplitude A1 and B1. The differential amplifier 68 outputs the difference of these outputs further, and an actuator 70 drives it according to the output. That is, an actuator is driven so that it may be set to value B-2-A2=A1-B1 of the modulation amplitude. Thus, if an actuator is controlled, the optical spot 35 for heat treatment

shown by drawing 3 can pass right above [of the 1st wobble pit 16 or the 2nd wobble pit 17], and can heat-treat just between the record regenerative tracks 21.

[0046] Although the above explained a means to control an actuator so that it might be set to value B-2-A2=A1-B1 of the modulation amplitude, it can perform similarly controlling to A1=B-2 stated by the above 1 and 2, or B1=A2.

[0047] Although it is necessary to perform heat treatment between recording tracks in order to heat-treat between recording tracks on DWDD disks and to make DWDD actuation perform smoothly, the narrower possible one can narrow a track pitch and the densification of this heat treatment width of face becomes possible. In order to heat-treat narrow width of face, as for the wavelength of laser 40, in the optical disk thermal treatment equipment of this application, it is desirable to use short wavelength laser 500nm or less.

[0048] Moreover, it is also effective to use the objective lens (for example, NA=0.8) of high NA, and to narrow the beam spot. When using the objective lens of high NA, even if it irradiates a light beam from the record stratification side of a disk and a disk inclines in the optical disk thermal treatment equipment of this invention, it avoids that the beam spot is distorted by aberration. It is because it will become difficult for a focal gap to arise in change of the thickness of a substrate, or for comatic aberration to occur in the inclination of a disk, and to carry out good heat treatment, while using the objective lens of high NA especially if light is made to supply over a substrate.

[0049] Furthermore, in the optical disk thermal treatment equipment of drawing 1, it is designed so that the optical spot 35 for heat treatment may become smaller than the optical spots 36 and 37 for tracking among three optical spots 35, 36, and 37. Although the smallest possible spot of the optical spot 35 for heat treatment is desirable, proper magnitude is required for the size of the optical spots 36 and 37 for tracking.

[0050] When the optical spots 36 and 37 for tracking pass right above near the 1st wobble pit 16 and the 2nd wobble pit 17, the quantity of light 50 thru/or the modulation amplitude A1, A2, and B1 of 51, and B-2 are because it is necessary to become a value suitable for control of tracking. For example, the diameter of the 1st wobble pit 16 and the 2nd wobble pit has desirable 0.4 to 0.6 micrometers at the time of 2= 1.2 micrometers of LW1=LW(s), and the spot size of the optical spots 36 and 37 for tracking has a desirable spot size of 0.35 to 0.45 micrometers at half-value width. As for the optical spot 35 for heat treatment, extracting to 0.3 micrometers or less is desirable.

[0051] How to make small the optical spot 35 for heat treatment compared with the optical spots 36 and 37 for tracking as mentioned above is explained using drawing 5 . Drawing 5 is what displayed a part of drawing 1 , and the number of each part corresponds with drawing 1 . 80 of drawing 5 is drawing which looked at the diffraction grating 42 from [of light] incidence. The part by which the grid is formed in the actual

condition of a diffraction grating 42 is the diffraction region 81 near the core. Incidence of the parallel light is carried out to the field shown in the diffraction grating 42 with the broken line 82. Only the light which passed a part for a core is diffracted in the direction of an arrow head 83 by the diffraction grating in a diffraction region 81. The primary diffracted light of the diffracted light serves as the beams 32 and 34 for tracking.

[0052] The beams 32 and 34 for tracking become a part of light by which incidence was carried out to the diffraction grating 42, and pass along some objective lenses. Therefore, whenever [substantial opening], i.e., NA value, is small. Since any parts other than diffraction-region 81 of the light beam which carried out incidence to the field shown with the broken line 82 of a diffraction grating 42 on the other hand are not diffracted, they go into an objective lens, with the diameter of the flux of light as it is maintained. In this light beam 33, i.e., the beam for heat treatment, in order [of an objective lens] to go into the whole region mostly, whenever [opening] becomes large and the diameter of a spot becomes small.

[0053] When only a core uses the diffraction grating 42 with a diffraction function as mentioned above, the optical spots 36 and 37 for tracking formed by the primary diffracted light 32 and 34, i.e., the beams for tracking, can be made smaller than the optical spot 35 for heat treatment, and tracking and each optimal optical spot for heat treatment can be formed. Moreover, since the beams 32 and 34 for tracking are the primary diffracted lights of the light which carried out incidence only to the diffraction region 81 of a diffraction grating 42, they are taper reinforcement from the beam 33 for heat treatment.

[0054] The area of a diffraction region 81 can be changed and the reinforcement of the beams 32 and 34 for tracking and the beam 33 for heat treatment can change the ratio of primary light by the design of a diffraction grating. As for the ratio of the optical reinforcement of the beam 32 for tracking, the beam 33 for heat treatment, and the beam 34 for tracking, carrying out to about 1:8:1 is desirable. It is because reinforcement required for tracking is better than the optical reinforcement used for heat treatment at least. In addition, 84 shows the condition of the spot formed in the disk side, and the arrow head 31 shows the hand of cut of a disk. The direction of the diffraction grating of a diffraction region 81 is also made to incline to a disk side, and it is designing so that each spot may be formed, as drawing 3 showed, so that the optical spots 36 and 37 for tracking may serve as physical relationship which inclined to the transit direction 85 of a disk.

[0055] The track pitch of record playback tried heat treatment to the sample servo disk which is 0.6 micrometers using the objective lens of NA0.85 using 410nm blue semiconductor laser with the optical disk thermal treatment equipment of the above-mentioned configuration. When the sum total light power on the disk side of the beams 32 and 34 for tracking and the beam 33 for heat treatment heat-treated by

8mW by 5 m/s, the linear velocity of a disk could heat-treat the imaginary line top passing through the 1st wobble pit 16 and 2nd wobble pit 17 top good by width of face of 0.2 micrometers or less, and its reproducing characteristics in DWDD were also good.

[0056] Although it is the case where the sample servo disk which has not prepared the groove is used for a disk, in drawing 1 of the above-mentioned explanation, drawing 2 , and drawing 3 , also in the sample servo disk in which the very shallow groove shown in drawing 11 with the effectiveness which prevents diffusion of the heat of a heat treatment beam was formed, the above-mentioned optical disk thermal treatment equipment can be used convenient at all. It is because the groove prepared on the disk for the tracking of a light beam is not used.

[0057] Furthermore, although the diffraction region of the diffraction grating 42 used for the optical disk thermal treatment equipment of this application showed the case of being circular, it can be made into an ellipse form as shown in drawing 6 A, or a rectangle as shown in drawing 6 B according to the beam profile of the light beam by which incidence is carried out to a diffraction grating 42, and can form the optimal spot for heat treatment and tracking on an optical disk.

[0058] In addition, in the case of this example, the distance L1 of the radial direction of the optical spots 36 and 37 for tracking shows one half of the cases of the pit pitches LW1 and LW2 of the radial direction of the 1st wobble pit 16 or the 2nd wobble pit 17, but if even the conditions of L1 !=nxLW1 and L1 !=nxLW2 are fulfilled, it is controllable satisfactory. The example of such the beam spot is shown in drawing 7 . In drawing 7 , L1 is three fourths of the distance of LW1 and LW2 mostly.

[0059] (Gestalt 2 of operation) Drawing 8 is the case of the 2nd operation gestalt. Since the corresponding number is the same as the gestalt 1 of operation, explanation of a number is omitted. In the case of this 2nd operation gestalt, it is the case that the distance L1 of the radial direction of the optical spots 36 and 37 for tracking is equal to the distance LW1 between the 1st wobble pits 16, or the distance LW2 between the 2nd wobble pits 17.

[0060] Although the thing out of control was explained with the gestalt 1 of operation when it was not L1 !=nxLW1 and L1 !=nxLW2 Even case [like L1=nxLW1 and L1=nxLW2], 47a of a photo detector 47, And 47c can be comparatively made respectively for 2 minutes, and it can be made to run the beams 32 and 34 for tracking along with the imaginary line on the 1st wobble pit 16 or the 2nd wobble pit 17 respectively by using those differential signals. That is, when the optical spots 36 and 37 for tracking pass through the 1st wobble pit 16 or 2nd wobble pit 17 top, primary light occurs according to the diffraction effect of a pit. It can catch by the photo detectors 47a and 47c which divided the component of this primary light into two, and a tracking error signal can be generated.

[0061] It explains using drawing 8 below. In drawing 8 , the signals outputted from each

divided field of field 47a of a photo detector 47 are d and e, and, on the other hand, the signal of field 47c is set to f and g. The signal of d and f is added with a summing amplifier 90, and the signal of e and g is added with a summing amplifier 91. These outputs are subtracted with the differential amplifier 92, and this output signal is inputted into the drive amplifier 93, drives an actuator 94, and controls the optical beam spot to a radial direction. For example, when the optical spot 36 for tracking passes through the 1st wobble pit 16 top, in passing right above exactly, Signals d and e become equal, but if it shifts towards the upper and lower sides of drawing, the light included in photo detector 47a of drawing 8 will become unsymmetrical to the field of 2 division (the shape of a half moon shows at drawing 8), and a difference will come out of it between d and e. A difference comes out among Signals f and g similarly. If d+f=e+g controls equally like the above-mentioned explanation, as for each optical spot for tracking, it will pass through each wobble pit top. Therefore, a heat treatment spot can also pass through a wobble pit top, and can heat-treat between record regenerative tracks.

[0062] The differential amplifier shown by 90 and 91 in the circuitry of drawing 8 has the sample hold function here, and the timing which carries out sample hold is a time of passing through each wobble pit.

[0063] It was possible for the optical disk thermal treatment equipment of this configuration to also have heat-treated a DWDD disk with a good tracking property as mentioned above.

[0064]

[Effect of the Invention] As explained above, the optical disk thermal treatment equipment of this invention can hold and heat-treat the tracking property which could heat-treat between record regenerative tracks by heat treatment width of face narrow enough compared with the track pitch, and was stabilized.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing showing the configuration of the optical disk thermal treatment

equipment of this invention
[Drawing 2] Drawing showing the exposure physical relationship of the light beam of this invention
[Drawing 3] Drawing showing change of the reflected light when the light beam of this invention runs
[Drawing 4] Drawing showing the circuitry of the optical disk thermal treatment equipment of this invention
[Drawing 5] Drawing showing the function of the diffraction grating used for the optical disk thermal treatment equipment of this invention
[Drawing 6] It is drawing showing the operation gestalt of others of the diffraction grating used for the optical disk thermal treatment equipment of this invention, and A is the example of an ellipse form and B is a rectangular example.
[Drawing 7] Drawing showing the light beam of this invention, and the physical relationship of each wobble pit
[Drawing 8] Drawing explaining the 2nd operation gestalt of the optical disk thermal treatment equipment of this invention
[Drawing 9] Drawing showing the configuration of an optical disk
[Drawing 10] Drawing showing the conventional heat treatment
[Drawing 11] Drawing of the sample servo system disk at the time of preparing the very shallow groove section
[Drawing 12] Drawing of a sample servo system disk without a groove
[Description of Notations]
1 Optical Disk
2 Substrate
3 1st Dielectric Layer
4 Recording Layer
5 2nd Dielectric Layer
6 Protection Coat Layer
7 Groove Section
8 Land
9 Laser Light
10 Objective Lens of Thermal Treatment Equipment
11 Level Difference between Land Grooves
12 Fluctuation of Groove Section Side Face
13 Servo Field
14 Data Area
15 Segment Field
16 1st Wobble Pit
17 2nd Wobble Pit
19 21 Record regenerative track

20 22 Heat treatment truck
30 Optical Head
31 Disk Hand of Cut
32 34 Beam for tracking
33 Beam for Heat Treatment
36 37 Optical spot for tracking
35 Heat Treatment Spot
40 Laser
41 Collimate Lens
42 Diffraction Grating
43 Deviation Beam Splitter
44 Quadrant Wavelength Plate
45 Mirror Prism
46 Concave Lens
47 Photo Detector
50 51 Quantity of light
52 Level of Quantity of Light 0
A1, B1, A2, B-2 Modulation amplitude
60 61 Amplifier
62, 63, 64, 65 Sample hold circuit
66, 67, 68, 92 Differential amplifier
69 93 Drive amplifier
70 94 Actuator
71 Timing Signal Generator
80 Drawing Which Looked at Diffraction Grating from Optical Incidence
81 Diffraction Region
83 The Diffraction Direction
90 91 Summing amplifier